ing hygrometer there is an additional meteorological reason for securing such specimens.—ED.]

4. For high ascensions by aeronauts in person, the Germans have adopted the method of breathing pure oxygen enclosed under a pressure of 150 atmospheres within a steel tube, as being much preferable to Paul Bert's method of carrying a mixture of 30 per cent of oxygen in a gas bag at ordinary pressures. They consider the breathing of pure oxygen a matter of primary importance in such ascensions.

It is well known in America that our own veteran aeronaut, Prof. S. A. King of Philadelphia, has during his life-long experience never failed to urge the importance of balloon ascensions to the meteorologist. In 1871, he in connection with the present writer, laid before the Chief Signal Officer a report recommending that telegraphic stations send up small free balloons in order to ascertain by simultaneous ascents the general direction and velocity of the wind for 1,000 feet above the ground. Although this proposition was not accepted, yet a beginning was made in the utilization of the balloon for meteorological purposes and the following account of the work of the Signal Service is corrected from Bulletin 11, Part 2, p. 275, Report of the International Meteorological Congress held at Chicago, August, 1893:

Through the enthusiastic cooperation of Prof. King the Signal Service was subsequently enabled, at slight expense, to send observers on aerial voyages, as follows: 1872, Mr. Schaeffer ascended with Mr. King from Rochester, N. Y.; 1877, Mr. Ford went up at Nashville, Tenn., on April 3, June 18 and 19; 1881, September 12, Mr. Upton went up from Minneapolis, Minn., and a few weeks later Mr. Hass-Hagen ascended from Chicago. In 1885 an arrangement was made with Professor King by which a number of ascensions were to be made from Philadelphia, Pa., whenever ordered by General Hazen. In accordance with this plan five ascents were made, four of them in the special interest of meteorology, with Mr. W. H. Hammon as observer, and the last one in the special interest of military signaling and balloon photography. Through the kindness of another aeronaut, Mr. Allen, similar privileges were by him accorded to Professor Hazen, who has made several ascensions. The valuable results of all these latter aerial voyages have been published in the American Meteorological Journal.

The recognition thus given, ever since the voyages of Gay Lussac and Glaisher, to the important data that meteorology may obtain by cooperation with aeronauts has been followed by the development of a growing interest in the subject. As the large balloons manned by at least one aeronaut and one observer required a large outlay of money and time, and as such ascensions can not be made in our very coldest weather, nor during high winds, and with difficulty during rain or snow, and as many observers can not ascend, above 25,000 feet without increasing inconvenience and even danger, there is every incentive to develop meteorological aeronautics along the line of activity which was initiated by Berson and Hermite, and has been most successfully pushed by Hergesell and Assmann. In the MONTHLY WEATHER REVIEW for November, 1894, p. 507, will be found some details of the remarkable ascensions made by Dr. A. Berson on December 4, from Berlin; he attained the height of 30,000 feet and the observations made by him were of great value. This represents the very best that has been done by personal ascension. On the other hand the unmanned balloon "Cirrus" from Berlin, attained 55,000 feet, September 6, 1894, and in the MONTHLY WEATHER REVIEW for January, 1896, p. 16, there will be found an account of the ascension near Paris of a small balloon, the "Aerophile," without personal attendant, carrying only a light piece of self-registering apparatus. Two such voyages are there mentioned, that of October 20, 1895, which attained over 50,000 feet, and that of March 27, 1896, which attained 43,000 feet. Science owes a debt of gratitude to Assmann and Berson of Berlin, and MM. Gustave Hermite and Georges Besancon of Paris, who invented the apparatus and carried out these experiments. It is in this line of work that observational meteorology is now to make its next great advances. The photography of the earth, as seen from the balloon, a matter that has recently been much discussed in New York City, has been practiced by the French aeronauts for many years, beginning with Triboulet in 1876, and recently they have added even the photography of clouds. A splendid series of photographs of Philadelphia and its environs was taken by Prof. S. A. King and assistants in 1885.

## THE FRANKLIN KITE CLUB.

We have on several occasions published in the MONTHLY WEATHER REVIEW such items as we could gather relative to the Franklin Kite Club of Philadelphia, which seems to have been the most systematic effort as yet made to develop the kite for meteorological purposes. Quite recently Mr. William J. Rhees, who was for many years Chief Clerk of the Smithsonian Institution under Professors Henry and Baird, informed us that he had obtained an interesting item in connection with the life of the late William B. Taylor, who was born in 1821 in Philadelphia, but for over forty years was well known as one of the most learned and able of the scientific men employed in the Patent Office and the Smithsonian Institution.

Mr. Rhees kindly communicates the following abstract from his unpublished manuscript memoir of Mr. Taylor:

While attending school in the winter of 1835–36, Taylor lived with an aunt, who was the matron of the Philadelphia City Hospital (at Schuylkill, Fourth and Coates streets). This hospital was in the middle of a large lot surrounded by a fence, but free from trees or other obstructions.

In 1835–36 several gentlemen formed a society with the name of "The Franklin Kite Club," for the purpose of making electrical experiments. For a considerable time they met once a week at the City Hospital grounds and flew their kites. These were generally square in shape, made of muslin or silk, stretched over a framework of cane reeds, varying in size from 6 feet upward, some being 20 feet square. For flying the kites, annealed copper wire was used, wound upon a heavy reel 2 or 3 feet in diameter, insulated by being placed on glass supports. When one kite was up sometimes a number of others would be sent upon the same string. The reel being inside the fence the wire from the kite crossed over the road. Upon one occasion as a cartman passed, gazing at the kites he stopped directly under the wire and was told to catch hold of it and see how hard it pulled. In order to reach it he stood up on his cart, putting one foot on the horse's back. When he touched the wire the shock went through him, as also the horse, causing the latter to jump and the man to turn a somersault, much to the amusement of the lookers on, among whom was Taylor.

It was this incident and others of a similar character connected with the Kite Club, that turned his youthful mind to science and especially to electrical phenomena.

## THE USE OF THE KITE IN METEOROLOGY.

For many years the Editor has been collecting the literature relative to the use of the kite in meteorology, and this collection has been freely used in the writings of Prof. C. F. Marvin and Mr. A. L. Rotch. In a review of this subject by Mr. A. Lancaster, in *Ciel et Terre*, he calls attention to the work of Mr. W. R. Birt and Sir Francis Ronalds, who in 1847 organized a series of experiments at the Kew Observatory, an account of which is given in the London, Edinburgh, and Dublin Philosophical Magazine, September, 1847 (3), XXXI, p. 191, and as the short article is but little known, we reproduce it as follows:

Mr. W. R. Birt (on the 14th of this month, August, 1847) took some kites, etc., to the Kew Observatory, for the purpose of endeavoring to ascertain how far it might be practicable to measure the force of wind at various elevations by their means, and (in the mere manipulation of his experiments) was assisted by Mr. Ronalds. After several trials, etc., they agreed that the sudden variations, horizontal and vertical, in the position of the kite, the great difficulty of making a kite which should present and preserve a tolerable approximation to a plane, that of measuring with sufficient accuracy, at any required moment, its inclination, and lastly, the influence of the tail, would always tend to render the observation somewhat unsatisfactory. Mr. Ronalds then proposed to try the following method of retaining a kite in a quasi invariable given position. Three cords were attached to an excellent hexagonal kite of Mr. Birt's construction; one in the usual manner, and one on each side (or wing). The kite was then raised as usual; the two lateral cords

were hauled downward by persons standing at the apices of a large equilateral triangle (described upon the ground) until the ascending tendency became considerable (even when the force of the wind was at its minimum), and the three cords were made fast to stakes or held in the hand. He had entertained no expectation of the favorable result of this simple and obvious contrivance. The place of the kite did not seem to vary so much as one foot in any direction, and it really appears to him probable that a very large kite or kites might be employed in this kind of manner *often* and very cheaply, as a substitute for a captive balloon in meteorological inquiries, or even (on a very extensive scale) for other requirements in military science, etc. An anemometer, a thermometer, an hygrometer, etc., of some registering kind, etc., might be hauled up and lowered at pleasure (like a flag) by a person standing in the center of the triangle (above referred to), and by means of a line passing through a little block attached to the kite. The cords and kite should of course be of pure silk, for the sake of lightness, combined with extreme strength, and the size and thickness in some measure adapted to the breeze or lighter air. The silk might be advantageously covered with a very light coat of elastic varnish.

With reference to the use of the kite in Belgium, Lancaster says:

About 1880 our late regretted colleague, Fr. Van Rysselberghe whose inventive genius was always on the alert, sought to solve the problem of making meteorological observations at great heights and in free atmosphere by means of kites. He constructed different models of these capable of carrying self-registering apparatus and success seemed about to crown his efforts when he was lured from these studies by a question which was engaging the attention of all investigators, viz, that of telephonic communications at long distances. We know with what ardor he pursued this subject and thus he was lead to completely abandon his kite work.

Among other notes Lancaster states that the so-called Malay kite is a transformation of the Chinese kite, devised by Mr. Millet, of New York City, whose experiments are described in the Aeronautical Annual. The Hargrave kite, so-called after the inventor, Lawrence Hargrave, of Clinton, New South Wales, Australia, is fully described in the successive volumes of the Proceedings of the Philosophical Society at Sydney. A full description is also given by Hargrave in the American Engineer for 1895. This form of kite is generally considered the most perfect of its kind. It has great stability. A kite of one square yard area can raise 6 or 8 pounds of weight. With six kites of two square yards area, 180 pounds can easily be raised from the earth. The total weight of the six kites with the cord would be 35 pounds. It is hardly necessary to say that the lifting force of the kite varies with the velocity of the wind when the surface area of the kite and its angle of inclination remain the same.

The dimensions of the Hargrave kites experimented upon by J. B. Millet, are given by him from the Aeronautical Annual, Boston, 1896, p. 127, and are as follows:

The smallest Hargrave weighed 1½ pounds and had an area slightly less than 9 square feet and would carry a thermograph weighing 3 pounds. A comparative experiment with a Malay kite weighing nearly 1 pound and having a total surface of 85 square feet, during a wind of from 20 to 25 miles per hour showed that the Hargrave kite had a pull of from 6 to 17 pounds, while that of the Malay kite was from 4 to 9 pounds. From this there results for the Hargrave kite a pull of from 7 to 19 pounds per square yard, but for the Malay kite from 6 to 11 pounds per square yard. The angular altitudes of the kites, as seen from the reel, are 45° to 50°.

## THE UPPER CURRENTS OF AIR ABOVE THE INDIAN MONSOON REGION.

Mr. W. L. Dallas, of the Meteorological Office at Calcutta, has published an abstract of an elaborate paper in which he discusses all available observations of the wind, and the direction of motion of the cirrus, cirro-stratus, and cirro-cumulus, and, finally, the highest pure cirrus. The observations refer to the Arabian Sea and the Bay of Bengal, and although his detailed tables and text have a local application, yet the following paragraph will be of universal interest:

In so far as we can trust these observations the registration of the movement of the clouds would undoubtedly be helpful in the determination of the movement of the upper currents of air. The author endeavored to bring the observations now under discussion into unison with the theoretical conclusion that there exists an easterly current when the sun is in the zenith, but at all seasons of the year inflowing northeast and southeast winds, at a moderate altitude, and outflowing winds at greater altitudes; but the recorded observations afford no confirmation of such a circulation. He also attempted to explain the upper currents by means of the assumed distribution of pressure over India at 10,000 feet above sea level. So far as one can see from one example it follows that it would be useless to rely upon observations of the motions of the clouds made by occasional observers in order to obtain any correct idea of the circulation of the upper layers of the atmosphere. This is the result of two causes, the first and most important is that in nearly all cases clouds are a phenomenon belonging to a disturbed condition of the atmosphere, and that the observations of their appearances and motions simply define the nature of the disturbances above the point of observation. As an example, the following case may be mentioned. To the north of Simla lie the snow-covered range of the Himalayas, and on clear winter days, which it may be mentioned, are far more numerous than the cloudy days, one may observe the cumulus clouds which are formed above the snow-covered mountains as the result of local evaporation. These clouds rise and move away from the snow-covered mountain tops above which they are formed and move from the mountain chain toward the southeast, thus demonstrating the existence of a current from the northwest toward the southeast at a level of from 20,000 to 25,000 feet above the sea, or 13,000 to 18,000 feet above Simla. This motion occurs uninterruptedly day after day, but suddenly the weather is disturbed; a depression appears on the daily map over Afghanistan and clouds move over Simla from the southeast and east toward northwest and west; if therefore, there were no artistic clouds produced to the north of Simla, such as occur during fine weather, then would the clouds that now come from the southeast be the only ones that are observed, and the natural conclusion would be that at a height of from 20,000 to 25,000 feet there prevails an upper current from the east and the southeast, whereas really this is an exception, and as a rule the current is from the opposite side. This would seem to show that a determination of the normal movement of the upper atmospheric circulation, by means of the ordinary observation of the clouds, is a process of very doubtful value.

Another important point is the classification of the clouds by different observers according to their altitude. In the case of the Indian monsoon region we may assume that there are three different atmospheric motions during the progressive advance of the southwest monsoon, which three movements are partially blended together above any given point. The lowest is the movement from the southwest which prevails from the surface of the ground up to very considerable altitudes and in which are numerous cumulus clouds. Above this the movement from southeast and east prevails; this current corresponds to the southeast trade wind in other tropical regions, but it now appears to belong to the upper atmosphere because of the monsoon below, at the surface of the earth. Finally, we have the return current from the thermal equator toward southern latitudes. Now it is exceedingly improbable that when these three currents exist clouds should be present in all three simultaneously. Consequently we come upon an inevitable confusion when one observer classifies certain clouds in the southeast current and certain others at a different time in the upper return current, as upper clouds in both cases and thus leads astray the investigator who is making the attempt to discuss all observations systematically in the same way.

An unusually careful and painstaking observer who is stationed at one place and desires to develop a theory on the basis of the continued study of the movements, forms, and altitudes of clouds that pass above him, might possibly be able to attain an approximate estimate of the changes of the weather that are now in progress, or even those that are about to happen in his neighborhood; but the author doubts very much whether it will be possible for him to determine the general motion of the air in the upper strata of the atmosphere with the help of the cloud observations that are made by a variety of observers at a variety of places and at very different times.

This is very much to be lamented since such a determination of the approaching weather is perhaps at present the most important demand that is made on meteorology.

## THE ORIGIN OF TYPHOONS AND HURRICANES.

The study of the formation and development of cyclones has been followed with the greatest minuteness under exceptionally favorable conditions by the meteorologists of India. In a recent essay (An Account of a Storm Developed in Equatorial Regions, Calcutta, 1896), Mr. W. L. Dallas has endeavered to decide whether the inrush of a saturated stormy wind from the southwest into a region of heated moist air, is